ATLAS Core Software - Status & Plans

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LBNL

US ATLAS

US LHC Computing Review

LBNL

January 2003

GAUDI and Athena

- This continues to be a good collaboration with LHCb
- Common code base shared by both experiments
- Experiment-specific code (services, algorithms, etc.)
  - In some cases ATLAS have adopted different services than LHCb
  - Consistency with overall architecture maintained
- The LCG has adopted a similar component-based architecture for core services (SEAL)
  - LHCb Chief Architect (Pere Mato) leads development team
  - We're contributing to the development of this (0.5-1.0FTE assigned)
  - Expect also this will be a relatively painless migration
    - Athena "personality" above SEAL core

Geant4 Simulation

- Geant4 fully integrated into Athena [LBNL/CERN]
  - Fully supercedes the earlier Fads/Goofy dedicated framework
  - Implemented as a combination of a Service and Algorithm
  - Uses same Generators as G3 and Atlfast fast-simulation
- Plug-compatible with Atlsim G3 simulation [BNL]
  - Again implemented as a combined Service and Algorithm
- Updated Hits classes being designed & implemented now
  - Common between G3 & G4
- Support for Monte-Carlo Truth in release 5.2.0 (mid-Jan 2003)
  - TruthAssociation
- Goal is production-capability for release 6.0.0 (end of Jan 2003)
  - Won't fully incorporate GeoModel (Geometry Modeller) until following release

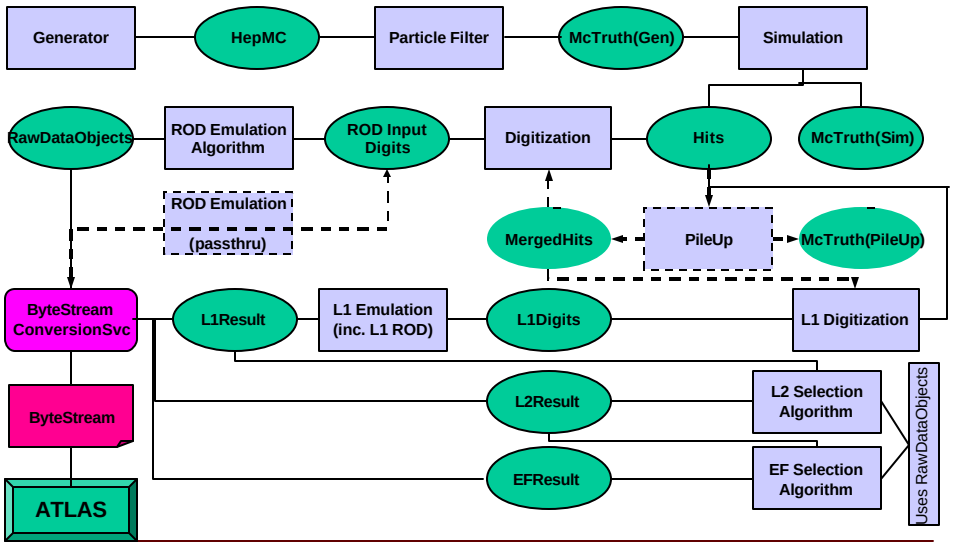
Pile-up Support [LBNL]

- Basic infrastructure delivered in March 2002
  - Support for multiple input streams
  - Time ordering structures
  - Combine hit collections from sub-events
- Prototype delivered in September 2002
  - Pixels/SCT used as testbed
- Pre-production version underway
  - In-memory caching and re-use of events to improve performance
  - Inner Detector and Liquid Argon supported so far
  - Performance studies using data from both ROOT and Zebra in progress
    - Results expected during Jan 2003
- On track for DC-2

Event Data Model

- Overall Coordination now a US-ATLAS Responsibility [BNL/LBNL]
- Framework [BNL, LBNL]
  - Ongoing performance and functionality enhancements to StoreGate data access service
  - Support for STL container classes
  - No requirement on common base class
  - DataHandle, DataLink, ElementLink
- Raw Event Data Model [BNL]
  - ByteStream Converter infrastructure
    - Emulation of data flow from detector
  - IdentifiableContainer for Raw Data Objects etc.
    - Efficient region of interest deferred access for the High Level Trigger environment

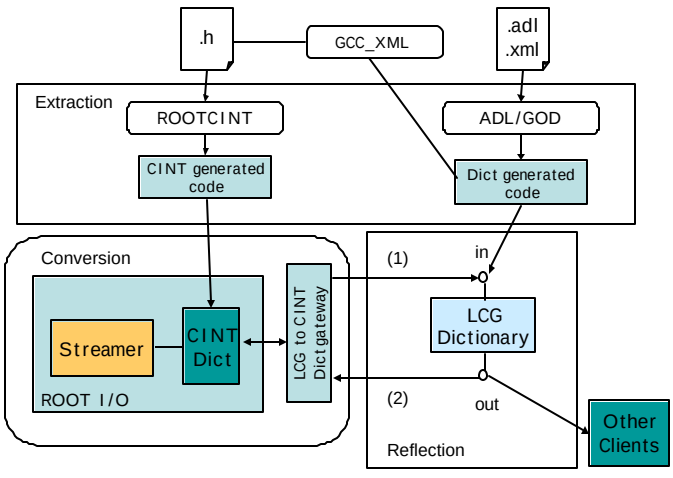
Simulation Data Flow



Data Dictionary [LBNL/Annecy]

- Automatic code generation from data model specification (ADL)
- Following intense discussions and meetings this was terminated by the Computing Steering Group after the November 2002 Software Week
- New plan is to join CMS in parsing C++ header files to load LCG Dictionary
  - Detailed strategy still being formulated
    - Interim solution using direct ROOT/CINT parsing probable because of timescales
  - Desire to have some persistency for Athens Physics Workshop in May 2003

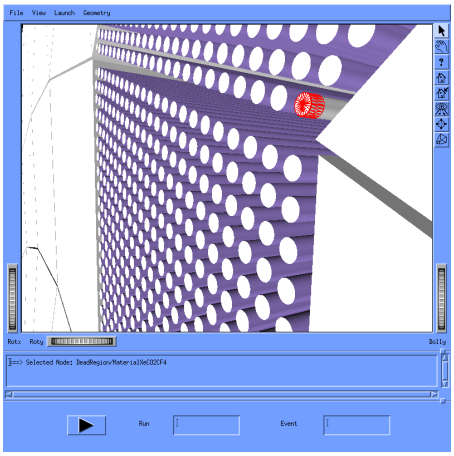
Data Dictionary [LCG]



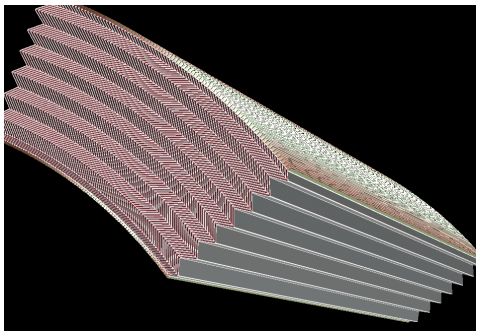
Detector Description (1)

- Geometry Modeller based on CDF [U.Pittsburg]
  - GeoModel
- Support for reconstruction, simulation & visualization
  - Support for time-varying mis-alignments being implemented now
  - First client of Interval Of Validity Service
- Extensive Optimizations
  - Shared instancing of logical volumes.
  - Shared instancing of (most) physical volumes, including subtrees.
  - Shared instancing of transformations.
  - Serial Denominator objects to save the space taken by strings.
  - Parametrizations
  - tiny::HepTransform3D to reduce the size requirement for most transformations.
    - specific transformations from 12 doubles to 1 float.
    - general transformations from 12 doubles to 6 floats.

Detector Description (2)



Detail from TRT



Detail from Barrel Liquid Argon
(parameterized - 40kB in memory)

Support for Calibrations/Alignment

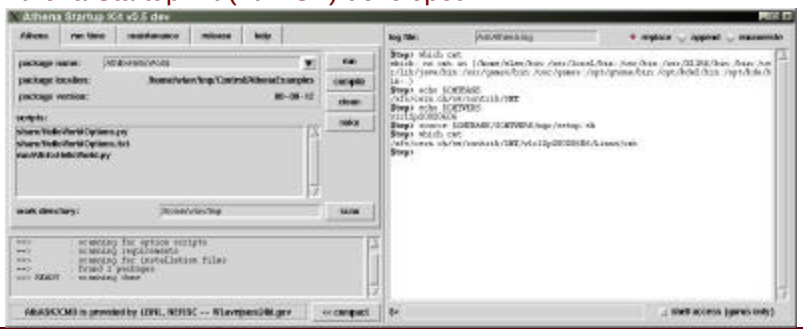
- NOVA MySQL Database [BNL]
  - Repository of persistent configuration information
- NOVA Service [ANL]
  - Retrieval of transient C++ objects from NOVA Database
- Conditions Database Service [ANL/Lisbon]
  - Access to time-varying information based on type, time, version and key
  - Used in conjunction with other persistency services (e.g. NOVA Service)
- Interval Of Validity Service [LBNL]
  - Registration of clients; retrieval of updated information when validity expires; caching policy management
- Scheduled for Release 6.0.0 (end of Jan 2003)
  - Prototype at Silicon alignment workshop in December 2002
    - Missed this goal by 24 hours

GRID Enabling Athena

- Much of effort so far has been on developing middleware
- Data access and management, job submission, authentication, etc.
  - ANL and BNL efforts have focussed on this
  - LHCb also looking at job submission
    - GANGA
      - Now a joint ATLAS/LHCb project
- LBNL group begun to look at integration into Athena itself
  - Initial testbeds incorporate GRID monitoring capabilities
    - Collaborations with:
      - Valerie Taylor (NorthWest) - Prophesy
      - Brian Tierney (LBNL) - GRID Monitoring Architecture - NetLogger
        - **Part of SC2002 demonstration**
        - **Prototype in Release 5.2.0 (mid-Jan 2003)**
  - Other potential testbeds being identified
    - Message logging
    - Distributed histogramming
    - *Etc*.

Scripting

- Funding shortfall caused a ~4 month hiccup at beginning of FY2002
- New functionality developed by ATLAS and LHCb (based on Python)
- Second generation version now ready for general deployment (6.0.0)
  - Access to Algorithms, Services & Data Objects
- Athena Startup Kit (AthASK) developed



US-ATLAS Involvement with LCG Activities

- RTAGs
  - Persistency
    - Headed by David Malon (ANL)
  - Detector Description
    - Steven Goldfarb (U.Mich.) & Joe Boudreau (U.Pitts.)
  - Architecture Blueprint
    - Torre Wenaus (BNL), David Quarrie (LBNL) & Craig Tull (LBNL)
  - Generators
    - Ian Hinchliffe (LBNL)
- Working Groups
  - POOL
    - Steve Eckmann (ANL), David Malon (ANL), Victor Perevoztchikov (BNL), Craig Tull (LBNL)
  - Configuration Management
    - Alex Undrus (BNL)
  - Core Services
    - Massimo Marino (LBNL), Wim Lavrijsen (LBNL)

Future Deliverables

- Multi-threaded Athena
  - Requested by Level 2
- "Reconstruction on demand"
- Improved Random Number Generators
  - In 5.2.0
- Physics Analysis Framework
- New Services
- Multi-language support
  - E.g. Java Services & Algorithms
- Integrated GRID services
- All coupled to LCG plans

LBNL Presence at CERN

- LBNL has maintained one or two developers at CERN full-time
  - Craig Tull and Massimo Marino
- Goal is to maintain approximately 1-2 people there
  - Has proven to be really useful and beneficial
  - But a strain on maintaining critical mass at LBNL
- Extend Massimo until Sep-Nov 2003
  - Tentatively planning on replacing him with another LBNL engineer
- I will be resident at CERN at 75% starting in Jan 2003 for 6 months and then 12 months at 100% and finally 6 months at 75 or 100%
  - Two year term as Software Project Leader

Summary

- Athena adopted as ATLAS framework
- Good progress on integration of G4 simulation and pile-up
  - Production-quality Athena/G4 integrated framework scheduled for end of Jan 2003
- On target for calibration/alignment for DC-2
- GRID integration underway
- Good involvement with LCG
  - LCG architectural vision consistent with ours
  - Hopefully strengthened by my presence at CERN in 2003-2004